OPIC
OFFICE DE LA PROPRIÉTÉ INTELLECTUELLE DU CANADA

CIPO
CANADIAN INTELLECTUAL PROPERTY OFFICE

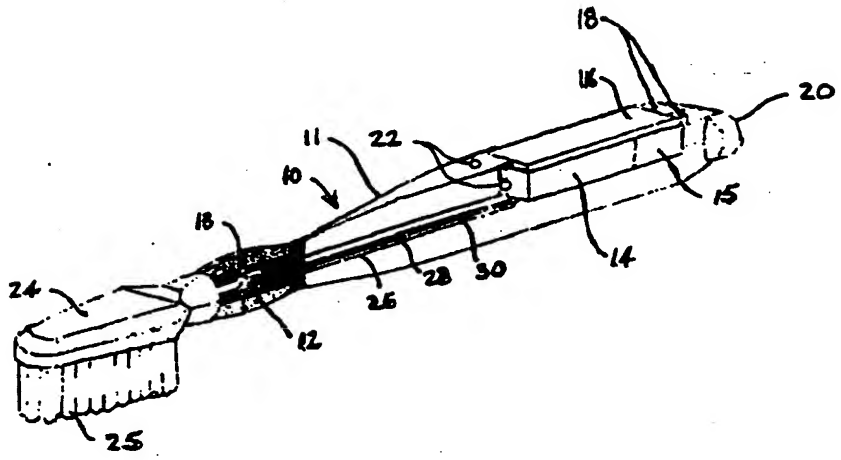
(12) (19) (CA) **Demande-Application**

(21) (A1) **2,232,528**
(22) 1998/03/18
(43) 1999/09/18

(72) NUYTTEN, Rene T., CA
(72) RICH, Christopher K., CA
(71) SMART PRODUCTS INC., CA

(51) Int.Cl.[6] A46B 17/08

(54) **BROSSE A DENTS « INTELLIGENTE »**
(54) **SMART TOOTHBRUSH**



(57) A toothbrush having a handle and a head with a microprocessor and sensor in the handle to detect force exerted on the handle. A display is coupled to the microprocessor and is operative to display output indicia output by the microprocessor. An input device coupled to the microprocessor and mounted on a surface of said handle receives user input information and transfers it to the microprocessor for processing. The combination of the display and the input device capable of entering input information allows the toothbrush to be interactive with the user unlike previous devices of this type.

ABSTRACT

A toothbrush having a handle and a head with a microprocessor and sensor in the handle to detect force exerted on the handle. A display is coupled to the microprocessor and is operative to display output indicia output by the microprocessor. An input device coupled to the microprocessor and mounted on a surface of said handle receives user input information and transfers it to the microprocessor for processing. The combination of the display and the input device capable of entering input information allows the toothbrush to be interactive with the user unlike previous devices of this type.

SMART TOOTHBRUSH

FIELD

The present invention relates to a toothbrush having a sensor, microprocessor and an input device which is capable of sensing details as to the brush stroke being applied, receiving user input information to customize the toothbrush to a particular user and to provide interactive sound and visual responses based upon the manner of brushing.

BACKGROUND

A toothbrush that contains strain gauge sensors to detect the direction frequency and duration of brushing and a microprocessor to analyze and process this information is disclosed in U.S. Patent No. 4,716,614 issued to Jones et al. Jones also discloses the use of an LED or bar graph recorder as a signaling device.

U.S. Patent No. 5,561,881 issued to Klinger et al. discloses an electric toothbrush with a position determining sensor such as a mercury switch or a magnet and a reed relay. The toothbrush is capable of computing and providing a performance report on by audio output or by lamps and segmental displays or histograms.

U.S. Patent Nos. 5,673,451 issued to Moor et al., 5,572,762 issued to Scheiner, 5,438,726 issued to Leite, 56,339,479 issued to Lyman, 5,134,743 issued to Hukuba, 4,744,124 issued to Wang et al., and 4,253,212 issued to Fujita all disclose toothbrushes in which lights/music/voice synthesizers are activated by switches when the toothbrush is in use.

None of the foregoing patents disclose an interactive toothbrush in which a user can input custom information to personalize the output information and the brush can sense and provide output information as to the type of brush strokes and interactive output information based upon the type of brushing.

SUMMARY OF THE INVENTION

According to the invention there is provided a toothbrush having a handle and a head with a microprocessor and sensor in the handle to detect force exerted on the handle. A display is coupled to the microprocessor and is operative to display output indicia output by the microprocessor. An input device coupled to the microprocessor and mounted on a surface of said handle receives user input information and transfers it to the microprocessor for processing. The combination of the display and the input device capable of entering input

information allows the toothbrush to be interactive with the user unlike previous devices of this type.

The sensor may include a resilient material bonded to the handle and to the head housing a contactor. The contactor may include an electrically conductive post and a plurality of electrically conductive segments disposed around the post and spaced from the post by a gap. Separate electrical lines couple to the post and to each of the segments such that in response to the post contacting a segment, an electrical circuit is closed causing an electrical signal to be sent to the microprocessor identifying the segment contacted. The positioning of the segments in combination with the post permits the detection of not only the presence of bending force generated between a user's hand and the head of the toothbrush but a measurement of the direction of that force relative to the plane of the toothbrush head. Thus, the present sensor measures a force vector and not just the presence of force.

The liquid crystal panel displays include icons selectable by the user and numerical and text data calculated by the microprocessor from sensor data and stored input data. Selection of custom icons and the type of data individualizes the toothbrush to each user.

A sound module is coupled to the microprocessor and operative to output voice and music.

The sound module outputs sounds of selected animals in conjunction with the display of icons characterizing those animals.

The input device comprises a selector button switch mounted on the handle and is responsive to depression to input data to the microprocessor.

The use of selectable icons, animal sounds and positive messages on the liquid crystal panel in response to detected brushing performance makes this toothbrush a valuable teaching tool for parents and dentists.

BRIEF DESCRIPTION WITH REFERENCE TO THE DRAWINGS

Further features and advantages will be apparent from the following detailed description, given by way of example, of a preferred embodiment taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a perspective view of the toothbrush with a half of the handle removed;

Fig. 2 is a perspective view of a portion of the handle containing the sensor; and

Fig. 3 is a top view of the liquid crystal display showing one of the various possibl displays.

DETAILED DESCRIPTION WITH REFERENCE TO THE DRAWINGS

Referring to Figure 1 the smart toothbrush 10 has a head 24 containing the brush 25 and a handle 11 affixed to the brush. Near the neck of the handle 11 is a sensor region 13 which houses a contactor 12 shown in more detail in Figure 2. Proximate the rear of the handle 11 there is housed a liquid crystal display 16 which is located directly above a microprocessor containing EEPROM memory 14 and an audio module 15. A battery 20 at the rear of the handle 11 powers the electronic circuitry. Electronic leads 26, 28, and 30 which run along the length of the handle interconnect the microprocessor 14 with the contactor 12. Selector switches which allow input from a user are positioned adjacent the liquid crystal display 16 while ON/OFF buttons 18 are located near the rear of the handle 11.

Referring to Figure 2 the contactor 12 is housed within a resilient polymer 40 is bonded to both the tooth brush handle 11 and head 24. Polymer 40 allows the handle 11 to bend in any direction. Contactor 12 consists of a central electrically conductive post 32 mounted in a sleeve 37 which is contained within the resilient polymer 40. Four electrically conductive contactor segments 34 (only two are shown) are arranged in a cylinder around the post 32 spaced a small distance away from the post 32. Electrical lead 28 connects by flexible line 36 t post 32, while leads 28 and

30 and two others (not shown) connect to each of the segments 34. As the head and handle flex about the sensor region 13 the post moves in the direction of flexing and contacts one or two of the segments 34 and makes momentary electrical contact that allows current to flow back to the microprocessor so that the microprocessor can determine the direction of flexing. The response of the brush to various types of brush strokes may be stored in the EEPROM memory and used to determine the brushing characteristics.

Selector switches 22 allow the inputting by a user of program data to the microprocessor and EEPROM 14 and ON/OFF functions. The liquid crystal panel 16 displays text, numbers and icons that indicate the status of various parameters. The screen also has specialized signals to indicate what mode it is in and to indicate positive messages such as "doing a good job". The microprocessor and EEPROM 14 receives the sensor data from the contactor 12 and processes it based upon a program stored in the EEPROM and outputs the results on the liquid crystal panel 16. An example of the kind of display output on the liquid crystal panel 16 is shown in Figure 3.

The audio module 15 controls voice and music and can trigger a fairly sophisticated arrangement of up to 48 notes ranging from sad to deliriously happy depending upon how the user brushes. Proper brushing will require input as

to the proper ratio of up/down/back/forth and circular movements that constitute proper brushing. Proper us giv s the user a reward in the form of a few musical bars, a dolphin chirp or something similar. The audio module 15 provides bird chirps for bird or dolphin icons, bear humming and the like. Thus, the smart brush 10 functions as a "coach" to maneuver the young user into a proper routine in a completely positive manner.

Although the particular sensor is advantageous as it requires little power and presents a clean signal to the microprocessor other sensors could be used such as a Hall effect sensor, a pressure sensitive resistor, an inertial switch, an accelerometer, a mechanical point contact switch or a ferro-fluidic switch.

The microprocessor and EEPROM 14 goes to sleep 30 to 60 seconds after brushing stops in order to conserve battery power and wakes up in response to movement or interrupts "wake-up" or "sleep" with activation of the ON/OFF switch. A real time clock correlates brush strokes and time. Information from the contactor 12 is combined with information from the real time clock to determine such parameters as number of brush strokes (in each session and cumulative), pattern of brush strokes, data and time of brushing session. Other parameters such as velocity, pressur , angle f head relative to tooth plan , percentage

of strok s in a concave surround, etc., may be programmed into the microprocessor 14 for the use of a dentist, hygienist or parent.

Accordingly, while this invention has been described with reference to illustrative embodiments, this description is not intended to be construed in a limiting sense. Various modifications of the illustrative embodiments, as well as other embodiments of the invention, will be apparent to persons skilled in the art upon reference to this description. It is therefore contemplated that the appended claims will cover any such modifications or embodiments as fall within the true scope of the invention.

I CLAIM:

1. A toothbrush having a handle and a head with a microprocessor and sensor in said handle to detect force exerted on said handle, comprising:

(a) a display coupled to said microprocessor operative to display output indicia output by said microprocessor;

(b) an input device coupled to said microprocessor and mounted on a surface of said handle for receiving user input information and transferring it to said microprocessor for processing.

2. A toothbrush according to claim 1, wherein said sensor includes a resilient material bonded to said handle and to said head housing a contactor including an electrically conductive post and a plurality of electrically conductive segments disposed around said post and spaced from said post by a gap with separate electrical lines coupled to said post and to each of said segments such that in response to said post contacting a segment an electrical circuit is closed causing an electrical signal to be sent to said microprocessor identifying the segment contacted.

3. A toothbrush according to claim 1, wherein said liquid crystal pan 1 displays include icons s lectable by

said user and numerical and text data calculated by said microprocessor from sensor data and stored input data.

4. A toothbrush according to claim 1, including a sound module coupled to said microprocessor and operative to output voice and music.

5. A toothbrush according to claim 4, wherein said sound module outputs sounds of selected animals in conjunction with the display of icons characterizing those animals.

6. A toothbrush according to claim 1, wherein said input device comprises a selector button switch mounted on said handle and responsive to depression to input data to said microprocessor.

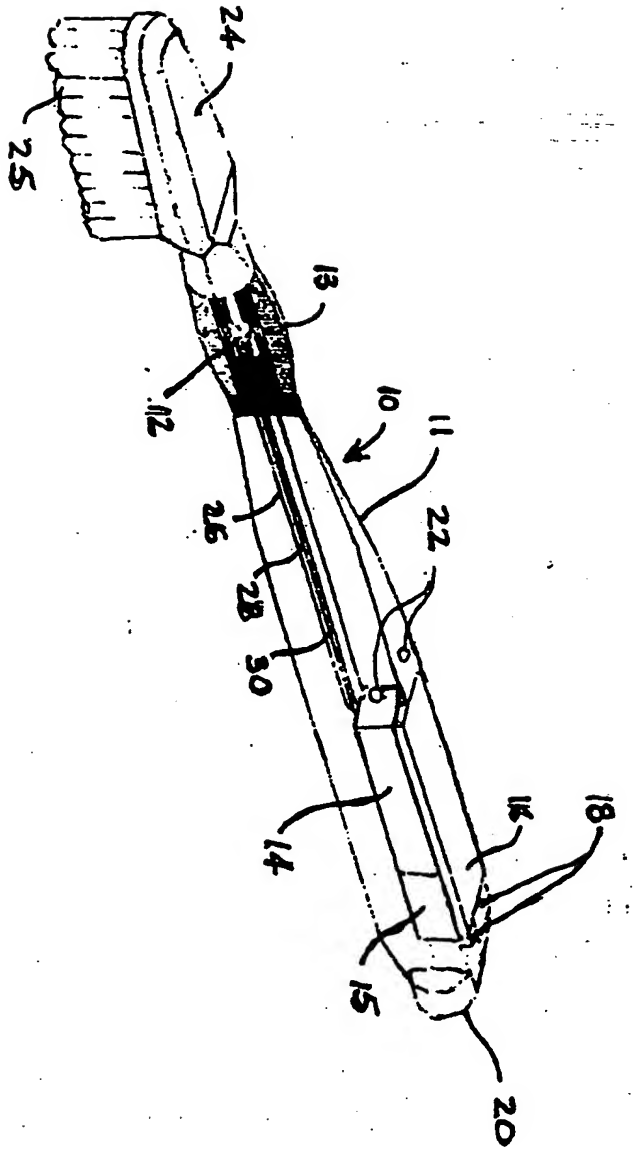


Fig. 1

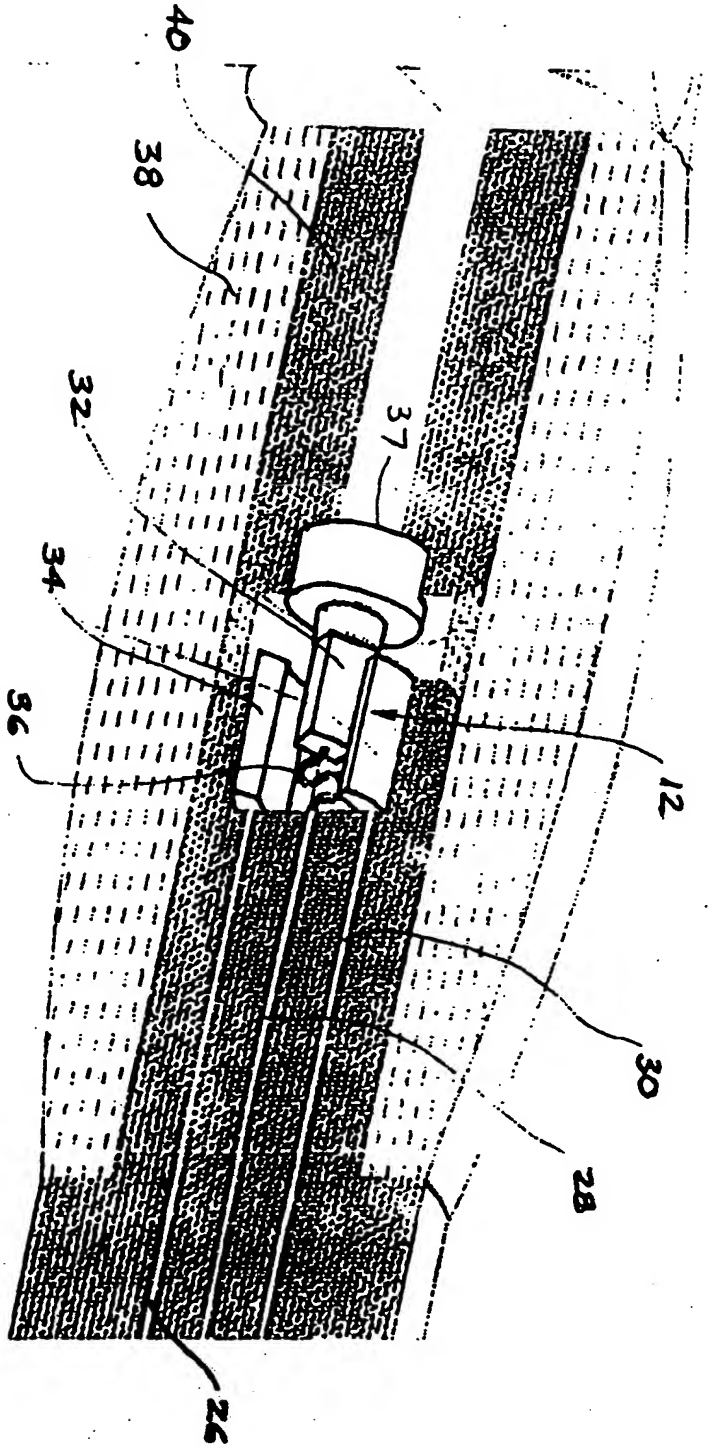


Fig. 2

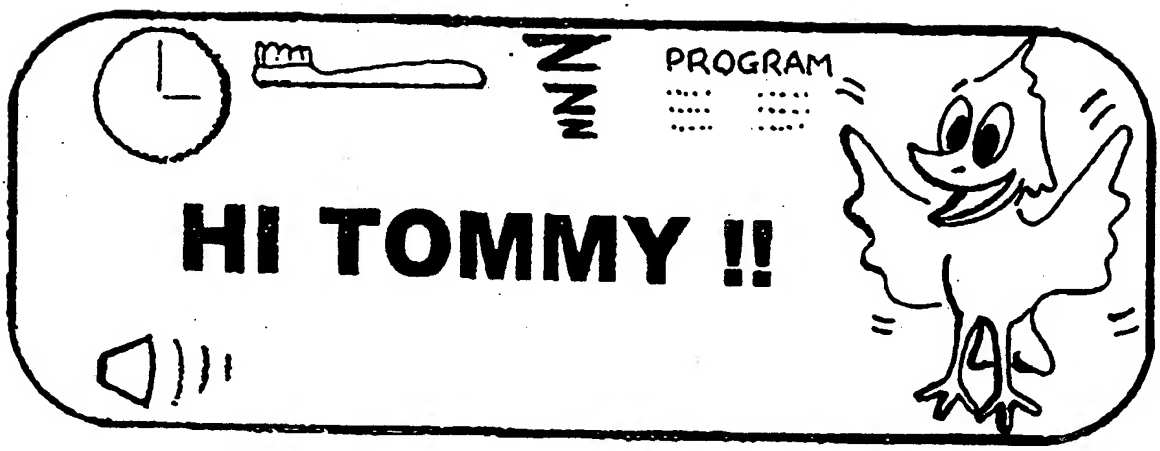


Fig. 3